

University-Industry-Government Relations. Some Reflections on Methodological and Policy Issues in the Context of Less Favoured Regions

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Abstract: Since the beginning of the eighties we are witnessing a broad recognition amongst economists and policy makers of the importance of knowledge accumulation for the economic growth. This context explains the reinforcement of knowledge, technology and innovation centrality in the researchers agenda as well as in the design of the economic policy.

As a result of the previous trends we need to consider two fundamental aspects from the viewpoint of regional and local development. First, the knowledge, technology and innovation play an important role on the performance of regional and local economy. Second, this means that the innovative activities emerge as a crucial vector of the process of convergence and inter-regional cohesion.

In this case, we think that the contextual conditions of less favoured regions involve a reconfiguration of the methods of evaluating the innovative potential and analysing the role of the components of institutional structure, the working of that composite and varied set of actors involved in the different stages of the innovation and diffusion process. More attention should be drawn to the evaluation methodologies of the innovative process and its potential, the strategic role of university (missions, teaching activities, research activities, new organisational forms, the relations between the organisation of the university and its environment, ...) and to the design of the public policy (financial support, demand-side policy, support to technological development and technological advice and guidance of local firms, regionalisation of technological policy, ...).

1. Introduction

In a more recent context, the analysis of the impact of the globalisation phenomena of the market over the local and regional economies as well as the competencies needed for the sustentability of competitive performance has attracted the attention of the analysts and policy-makers.

As a result we can see the difference of a growing articulation of the regional, scientific and technological policies. Consequently the valorisation of the potential of regional innovation and the creation and stimulation of the transfer mechanisms and the technological endogeneisation play a crucial role in the regional policy (see amongst others Ewers and Wettmann 1980; E. Maleki, 1983; OCDE, 1983; W. Molle, 1983 and W. Stöhr, 1986).

The university is not the only vector of the regional policy predominantly founded on innovation and on the transfer and endogeneisation of technology. However, we may consider that it has a strategic role in the development of the innovative potential.

In many situations, namely in less favoured regions, the pole with a better capability of endogeneisation as well as of production of knowledge and technology is the one that becomes heavier.

For this reason, this pole becomes one of the actors with more virtualities in the structuration of the basis of regional system of innovation. The instrumental nature given by the regional policy to the university imposes a re-evaluation of its role. The attributions of responsibilities in the revival of the regional and local socio-productive structure, overleaps borders of its traditional missions. The representation of the university as an academic community worried about the creation and transmission of knowledge and the preservation of its position as a place of critical research seems to be unsatisfactory.

To assure a high level of efficiency as a regional policy device, the university must count on the pre-requisites that are necessary for the valorisation of local resources. Moreover it must contribute for the reinforcing position of the regional and local economies within the international economic framework.

Considering all this, the role and functions of university face a lot of structural changes in what concerns missions, organisational structures, financial needs and strategic intervention in regions and places of settlement. These changes are not just internal. They have connections with the scope of the relationship with industry, the government and the other actors with relevance to the innovation dynamics.

The aim of this paper is to examine the role of the university as a structuring factor of the regional and local systems of innovation (RSI/LSI). To accomplish the previous objective, we start with reflections about some aspects of the relationship university and regional performances. Next we will analyse the observed theoretical and methodological trends and policy implications.

2. The Role of the University in the Regional Innovative Performance

The public decision about the location of university and its research structures in the regional policy does not consider optimal location criteria. This involves its settlement and functioning in environments with more or less adversity.

In this context the university faces a major challenge. It must answer not only to pedagogical as well as scientific quality patterns but also it must have a proactive role. These objective are often followed in environments with disadvantageous conditions of attracting population, particularly qualified human resources, with an incipient institutional framework and a weak cooperation culture.

This way, the operationalisation of such regional policy oriented to the creation of territorialised innovation systems can hardly stop being centred, in a starting phase, in the university and its research structures. This perspective seems to have a certain consistence.

The university becomes a qualified actor with capabilities to the development of competencies knowledge and training. This fact can increase the development of cooperation between university and firms. The excellence level in training is one of the critical elements in what concerns the creation of absorption and endogeneisation channels of the scientific and technological information (see W. Coffey, 1990).

This incubator action may allow the appearance of two important factors. On the one hand, a demand for technological services with a high degree of explicitation of technological needs (see J. Costa and M. Silva, 1994). On the other hand an increase in the quantity and quality of the supply of technological services. The existence of these two factors will clearly allow a better functioning of the regional technological market.

Within the framework of the internationalisation process we must recognise that the university may have, in regions strongly handicapped, a greater responsibility in the function of intermediation between the region and the outside. Its integration in scientific and technological networks assures not only this objective but it is also an important mechanism of endogeneisation and diffusion of innovation.

Its presence may develop considerably the level of the strategic competencies. We consider this effect of the utmost importance in a context where the lack of this asset is the main feature.

It is supposed that the university initiative gives a contribution for the valorisation of development projects with an important regional impact. The intervention areas are several: technological and organisational innovation, identification of the basic needs of the population, urban and rural fields, studies and proposals for actions and evaluation in the public policies, etc.

In what concerns the regional and local location factors, the university may contribute to the qualitative change of its pattern. On the one hand, the high level of competencies in the valorisation of the human capital and in technology services. It may arise the attractiveness of the exogenous firms initiatives in what deals with the quality and complexity of the resources to be used. On the other hand, its influence in the creation of an *agreeable* cultural, educational and urban environment (see Ph. Aydalot, 1986 and W. Sthör, 1986).

Obviously the success of the university as a means of development does not depend on its role action. The results are strongly connected with the quality of leadership of others actors, namely the government and the firms.

In a weak entrepreneurship framework the university and the government have a special strategical responsibility. This way, it becomes of the utmost importance the role of the public demand in the creation of the market conditions that enable at a starting and uncertain phase the economic valorisation with success of the technological opportunities generated by university research dynamics.

The efficiency of this process seems to depend on two pre-requisites. Thus, it demands a high level of articulation between different dimensions of the economic policy, mainly of the regional, industrial, scientific and technological policies. In addition, the university should go by the objective of the production of knowledge *per se* and develop knowledge with application potential in the production of new goods and services. This implies a change in the organisational model and the university research strategy of co-ordinates dictated by the market (see e. g. J. Caraça *et al* , 1997).

The operationalisation of this regional policy in peripheral areas that are open to phenomena of low economic and social vitality and a low population density arises issues for the complex territorial and methodological analysis.

Once we aim at analysing emerging systems with a relatively short lifetime and the dynamic externalities the static vision seems an inadequate representation of the phenomena. A systemic approach of the phenomenon shows more importance.

The analysis of the different interaction between the productive, the institutional, the educational, the scientific, the technological and the training levels shows more virtualities in the process of valorisation of the local innovative potential.

2. Systems of Innovation Approach and Innovation Theories: A briefly review

The development of the concept of Systems of Innovation emerge from the increasing recognition amongst economists and policy makers of the inadequate representation by neo-classic model and linear vision of the complexity intrinsic at innovative phenomena.

Innovation and diffusion process are social phenomena. As a consequence it's necessary to create new perspectives more useful and fruitful than the neo-classic economics tradition that support the analysis of all the elements, economics and extra-economics, with a very important influence on innovation performance. In other words, innovative activities as a socially embedded process cannot be understood without pointing out its institutional and cultural context. (see amongst others and C. Debresson, 1996 and C. Edquist, 1997).

Innovation is supposed to be the first commercially successful usage of new idea (products, processes, new organisational models, new markets, new inputs, according the Schumpeter) and its impact on technological change is strongly increased by diffusion process. It must be borne in mind, however, that behind much of innovation and during the diffusion process we can identify different mechanisms and connections between technological change and economic growth, involving science, technology, learning, production, policy and demand, that explanation might allow a better understanding of the nature of these relations.

The systems of innovation approaches provide us with an opportunity to work with a more comprehensive perspective. This explain, partially, its surprisingly fast diffusion and a greater interest by academic circles and policy makers.

However, we are not dealing with new or alternative theories of innovation, in an established and formal sense. According to C. Edquist (1997) systems of innovation must be interpreting as a *conceptual framework rather than formal theories*. He stresses that its development has emerged from foundations of different theories of innovation, namely interactive learning and evolutionary theories.

We are discussing systems and not system of innovation. It is easy to find in literature on this topic different perspectives, different *languages*, making the systems of innovation approach appear conceptually diffuse, with various kinds of ambiguities (see C. Edquist op. cit.). In any case, this situation does not reflect conflict but a complementary of point of view and the stage of the trajectory of knowledge in this field. The output of the surveys in this area provide us a common analytic framework.

For example, C. Freeman (1987:1) defines a National System of Innovation as *the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies*. Freeman places in centre of the concept the notion of *network of institutions*. Lundvall (1997) also underlines the relevance of the *institutional set-up* as a second important dimension of the system of innovation, after giving a central role to the *interactive learning*. Nelson (1993) points out to the relevance of *the institutions and mechanisms supporting technical innovation*, namely firms and industrial research laboratories.

The range of institutions involved is very wide: the political system, educational system, universities, industrial research laboratories, public or private, and other innovation support organisations.

Another point of view to understand the innovation and diffusion process and the use of technology is the Triple Helix Model (see H. Etzkowitz and L. Leydesdorff, 1997). This approach is based on three institutional spheres: public, private and academic. Their basic characteristic is a decentralised and interdisciplinary dynamic, self-organisation and a special attention is placed on the analysis in terms of interacting dynamics among university-industry-government relations *thus provide the dynamic infrastructure of a knowledge-based economy*. In this perspective a greater emphasis is given to the strategic behaviour of the actors, namely the role of the university and public policy in the task of translation knowledge and technology into economic production.

In regional literature we find concepts like regional/local systems of innovation, innovative environment and networks of innovation. R. Camagni (1991:1) stresses the importance of these concepts to the *interpretation of economic dynamics in terms of territorial relationships*. *Economic space became a 'relational space', the field of social interactions, interpersonal synergies and social collective actions that determine the innovative capability and economic success of specific local areas*.

Creativity and continuous innovation are seen as the result of a collective learning process, fed by such social phenomena as intergenerational transfer of know-how, imitation of successful managerial practices and technological innovations, interpersonal face-to-face contacts, formal or informal cooperation between firms, tacit circulation of commercial or technological information.

Despite this diversity the approaches are based, with different emphasis and narrow or broad perspective, on a systemic conception of innovative activities, continuous dematerialisation of the modelling of the innovative process, increasing endogeneisation of explanatory variables, strategic role of knowledge and mechanisms of accumulated know-how, relation structure/actors, collective organisation capacity, historical experience, cultural context and the level of openness of the system.

Another feature is a relative flexibility demonstrated that enable his operationalisation at different institutional backgrounds and social and cultural context. It seems adequate to analyse the innovation phenomena at various levels: national, sectorial, regional, local or transnational, as well as to select the relevant factors taking into account the specific context of the research.

3. Trends in Methodological Approaches on Regional Systems of Innovation

3.1. From a descriptive analysis to a qualitative evaluation

The recognition of the strategic role of knowledge and technology as well as the importance of its economic valorisation as a source of development has led researchers and government to increase their attention on the determinant factors of innovation phenomena. A particular emphasis has been focused on the methodological and evaluation dimensions as a means to better understanding and improve the tools of the operationalisation in this field.

With the increasing consolidation of the systemic approaches we observe a trend in the conceptions of new and improving the existing methodologies. An explanation for this trajectory is the shift of the emphasis on static to a dynamic efficiency. In this case, the data centred in input and output variables are limited to the assessment of the dynamic processes,

i.e., the innovative potentiality of the structural movements of change, of the crucial importance to the emergent systems of innovation.

Figure 1 shows us a perspective of different trajectories of the methodological approaches. The observed evolution points out to shortcomings of *classic choice* and underline the opportunities offered by the *innovative choice* to deepen the understanding of the issues and problems through a more comprehensive and systemic approach (evaluation, interfaces in the RSI, technological diffusion, regional diversity and specificity and qualitative and processes indicators) (see e. g. European Commission, 1995).

However, two intermediary approaches can also be identified. On the one hand, we have an approach of the evaluative nature (IV), without considering the interactive phenomena and its evaluation. On the other hand, zone II illustrates a descriptive analysis with concerns of systemic nature.

The strong points of the *innovative choice* are the articulation of the evaluation and the interactive dimensions, which permit supplementing the lack of the analytical and theoretical consistency of an approach only focused on the description of the technological and innovation system elements.

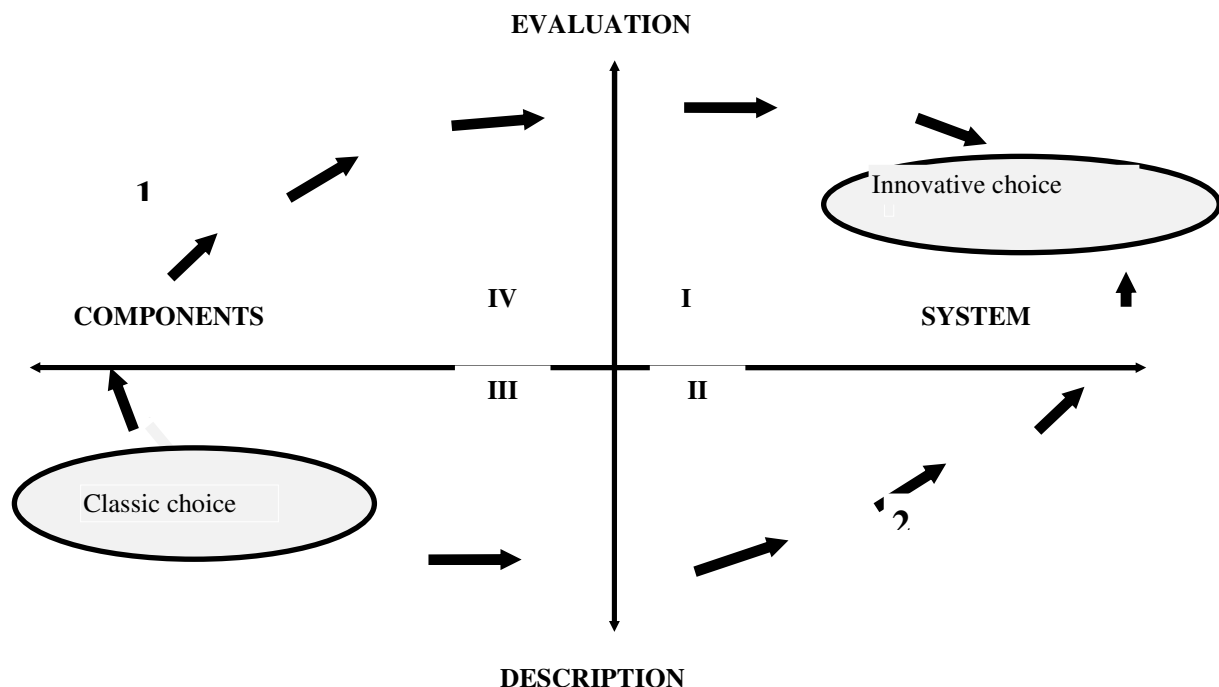


Figure 1 - Transitions from traditional towards innovative methodologies for evaluating regional innovative performance (European Commission, 1995)

Nevertheless, we must go on considering the description dimension of the constituent elements and actors participating in RSI and improve its tools of operationalisation. We argue that a description vision and intermediary approaches are necessary and useful methodological steps but not enough to explain the growing importance that is accorded to more immaterial sources of technological progress arising, e. g., from learning processes, clusters and networks forms of organisation and the structural effects of strategic behaviour of the actors. In sum, we observe a conceptual movement from a descriptive vision towards an evaluating systemic approach.

3.2 Input/output and process indicators

In this section we wish to focus on the effects of recent trends of the innovation process analysis on the representation, elements, characteristics and institutional dynamics, of the innovative phenomena , as well as on performance proxies.

Amongst others, one of the proposals of the representation of the RSI is presented in figure 2 Concerning this proposal we would stress, very briefly, the factors which we think have more impact and relevance to explain the performance system.

First, the research organisations (universities, laboratories), firms and innovation support organisations - ISO - (technical centres, technological brokers organisation, service companies in the technology area, chambers of commerce, business innovation centres, interface units of universities and research organisations, etc.) are identified as the key actors of the RSI.

Second, RSI aggregate, in an interactive way, scientific, technological, ISO, educational, training, cultural, market, commercial, economic and technological policies and institutional tissue in a given region.

Moreover, the attitudes, the traditions and the collective experience map the specific conditions of development. Indeed, the number, the nature and diversity of the variables considered bring out the importance for the research of the specific regional context.

Third, the proposal supplements the traditional input/output approach. Process indicators play a crucial role concerning the understanding of the dynamic structuration, the functioning and the evaluation of the RSI performance.

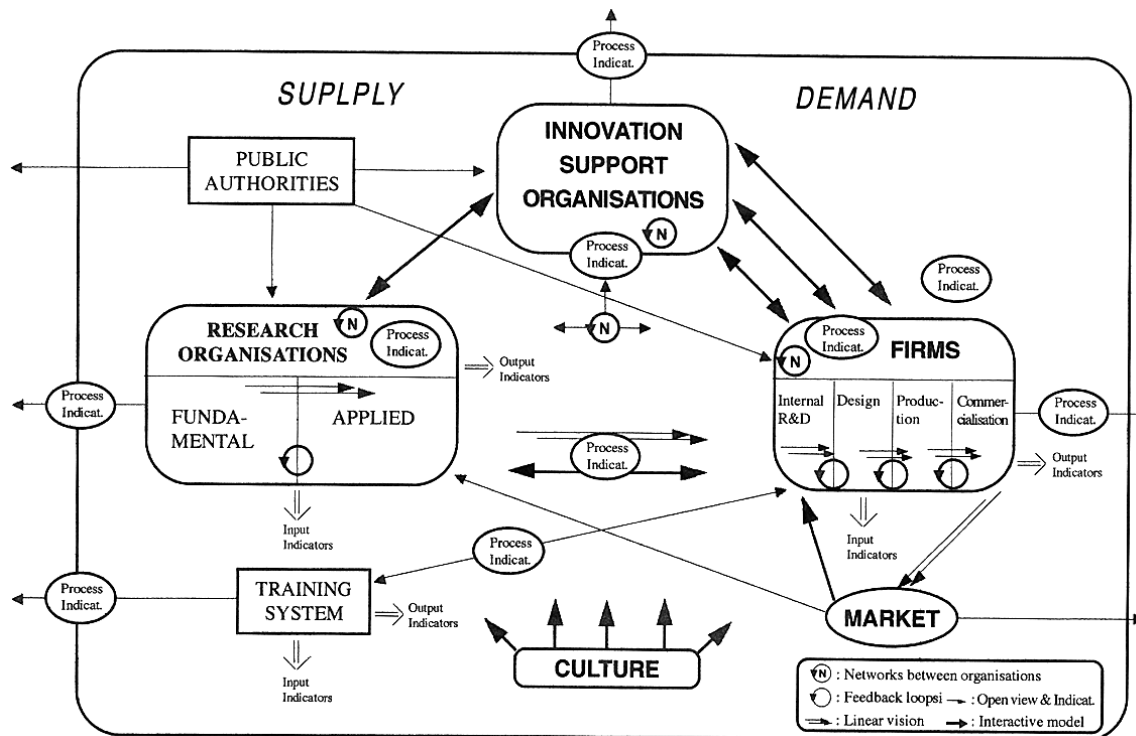


Figure 2 - Regional System of Innovation: Input-Output and Process Indicators
(European Commission, 1995)

The general recognition of the relevance of the institutional elements, the learning by interacting, the learning by using, the structural effects of the strategic behaviour of the actors explain the need of the developing new methodological approaches. The process indicators are, to a greater extent, the more adequate tools to capture these important forces, of a mainly qualitative nature, of the innovative activities.

In the context of lagging regions the process indicators have a crucial importance to assess the virtually of the emergent systems. The emphasis must be focused on the evaluation of the potential and not on an effective capacity.

However, some complex methodological problems arise from the operationalisation of a systemic approach. We refer to the lack of statistical data at a regional level, the impossibility to quantify and the great difficulty to operationalise phenomena like technology transfer, critical mass, spatial impacts, learning by interacting and by using and other complex variables.

Fourth, the analysis centred on qualitative data and on the importance of the specificity of the context makes inter-regional comparisons difficult and at best, approximate. Several efforts had been followed to provide more robust, reliable, coherence, comprehensive and

comparable set of data on RSI (see N. Alderman and M. Wood, 1994, D. Archibugi, 1994, European Commission, 1995 and A. Silvani, 1995). Nevertheless, it is necessary to improve the research on process indicators and a more selective applicability of the input/output proxies.

Fifth, the openness of RSI is of a crucial importance. The relations with exogenous partnership and international market at different levels improve the mechanisms of technological transfer and the effects of the learning by interacting. The required condition to success is the existence of the *absorptive capacity* and *capabilities to reorient* the technology transfer flows and experience according to an endogenous interest basis (see Marques Reigado and Alcino Couto, 1997).

Finally, we think that the perception of the role of the public authorities and university is not adequate to the context of less favoured regions. In our opinion the model is a better representation of the innovative phenomena of the economies that are placed in frontiers of stage-of-art. As a matter of fact, the strategic role of ISO can only be pursued with success if the actors have a high level of technological and innovation competencies and recognise the strategic importance of the innovation as a source of competitiveness.

In addition, the role of the public authorities is much more proactive than the model seems to represent. The importance of the public demand, e. g. in the case of the United States (M. Castells, 1984), and the strong intervention of the public Japanese authorities concerning the supply-side (tecnopolis and reinforcement of the links between universities, research organisations and firms) (see W. Stöhr, 1986 and M. Fransman, 1996) illustrate the need of the actions of public authorities to stimulate and consolidate emergent innovative activities and the economic valorisation of knowledge and technology.

In the less favoured regions a lack of strategic actors and competencies demands a more proactive role of the university and the public policy.

3.3 Methodologies to evaluate regional innovative performance: an eclectic approach

The results of the research on methodological issues provided us with several methodological proposals of a set of the methodologies and indicators as a means to

operationalise the research and evaluation of the potential of regional innovation and its process of construction.

One of them is ISI-Karlsruhe proposal. Figure 3 and table 1 show us the set of methodologies approaches and indicators as well as their more important features.

An important fact emerge from a general empirical research. All the studies tend to adopt one methodology or a narrow point of the view of this methodological framework. The consequences is to lose the coherence given by the global overview and interactive perspective. This elements are the most important characteristics of systemic approach (see European Commission, 1995).

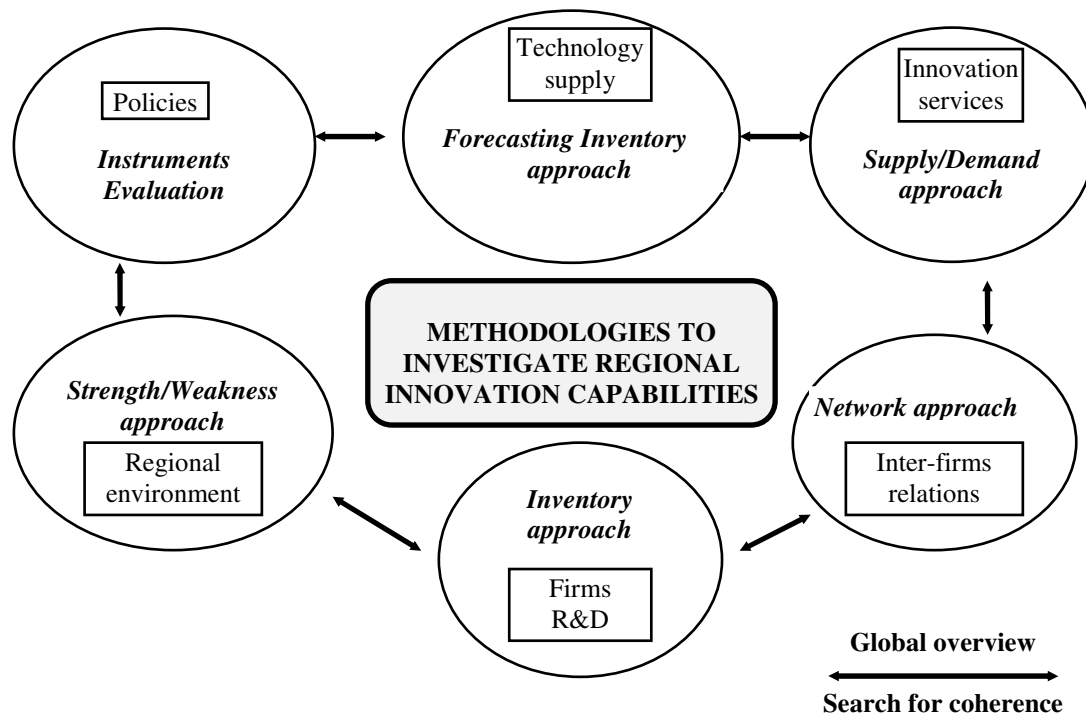


Figure 3 - Main dimensions of the RSI and associated methodologies (ISI-Karlsruhe, in European Commission, 1995)

The challenge is to supplement this situation. We need to improve the theoretical, methodological and data collections to enable insights into the crucial aspects of innovation phenomena. Another shortcoming of the proposal in what concerns the analyse of emergence or revitalisation of RSI is the few explicit importance drawn to the actors and the structural effects of their strategic conduct.

**Table 1 - Main dimensions of the RSI, aims, methodologies and data collections:
a general view**

DIMENSIONS	AIMS	METHODOLOGIES Fundamental guidelines	DATA COLLECTIONS Specifies
TECHNOLOGY SUPPLY: FORECASTING INVENTORY APPROACH	<ul style="list-style-type: none"> . to assess the technology supply potential . to identify the deficits in supply/demand relation . to define the position of the region in the context of inter-regional/international competition 	<ul style="list-style-type: none"> . to identify the technologies with the most regional importance, according to branch structure, technological competence and regional technological demand . to analyse how by whom are these technologies being utilised and how can the access to these technologies be improved . to analyse the adequate technologies considering the regional economic strategies . to identify the relevant emerging technologies and analyse its impact on regional competitiveness . to assessment the potential regional influence of higher education institutes . to assessment the receptivity of the regional economy . to analyse the importance of technology transfer at regional level 	<ul style="list-style-type: none"> . written questionnaires . interviews . discussion with experts, . evaluation of statistics reports and plans . quantitative and qualitative data
INNOVATION SERVICES: SUPPLY/DEMAND APPROACH	<ul style="list-style-type: none"> . to identify deficits in innovation services supply according to regional demand 	<ul style="list-style-type: none"> . to assist small businesses . to promote new businesses . to promote technology transfer . to promote communication between industry and academia . to support regional development . to support regional development 	<ul style="list-style-type: none"> . written questionnaires . interviews . evaluation of documents relating to suppliers and users of innovation services . quantitative and qualitative data
INTER-FIRM RELATIONS: NETWORK APPROACH	<ul style="list-style-type: none"> . to evaluation firms' propensity to network . to assessment the network regional dimension and the characteristics in terms of strengths/weaknesses 	<ul style="list-style-type: none"> . to analyse the type of partner involved (firm, institution, consultants, etc) . to examine their localisation (within the region, in neighbouring regions and outside the region, at national and international level) 	<ul style="list-style-type: none"> . written questionnaires and interviews with firms and innovation services, . evaluation of statistical sources . discussion with experts, chambers of commerce and industry and associations. . quantitative and qualitative data
FIRMS R&D EFFORTS & INNOVATIVE BEHAVIOUR: INVENTORY APPROACH	<ul style="list-style-type: none"> . to identify the R&D and innovation performance of regional firms 	<ul style="list-style-type: none"> . R&D expenditure/sales . Patents . Marketing expenditure . products, processes and organisational innovation . number of innovative projects . proportion of sale and export from new products or new processes . cooperation with technical research centres . cooperation with universities and research institutes . cooperation with other firms . fairs, exhibitions and meetings 	<ul style="list-style-type: none"> . written questionnaires and interviews with firms, . statistical sources. . quantitative and qualitative data
REGIONAL ENVIRONMENT: STRENGTHS & WEAKNESSES APPROACH	<ul style="list-style-type: none"> . to identify the regional weaknesses and opportunities or advantages 	<p>The analysis of the following areas:</p> <ul style="list-style-type: none"> . regional/national economic development policies . industry-related technological infrastructures . business related services . public-private mix of service . investment policy and local community finances . residential and income structure . commercial and industrial sites . retail trade agriculture and tourism . social infrastructure 	<ul style="list-style-type: none"> . discussion with experts from policy, industry and planning offices, centred mainly on the qualitative evaluation of data and on future development perspectives . statistical data . planning documents concerning different areas of development with regional influence: urban, rural sectoral economic policy, etc.
POLICIES: INSTRUMENTS EVALUATION	<ul style="list-style-type: none"> . to assessment of the regional impact of policy measures and programmes . to analyse the coherence between policies formulated and applied by different levels of government . to identify the possible means of improving policy measures and programmes 	<ul style="list-style-type: none"> . to analyse the different dimensions of regional policy . to examine the relative importance of the actors involved . to evaluation the instruments used . to analyse the organisation and networking aspects . to examine the relations between the central state and region 	<ul style="list-style-type: none"> . interviews with policy-makers, experts and entrepreneurs in region under investigation

Source: adapted from European Commission, 1995

We think that the proposal presented by M. Luger *et al* (1991) is more fruitful to examine the process of construction of RSI from the point of view of the behaviour of the actors. Figure 4 show us a conceptual model of knowledge production.

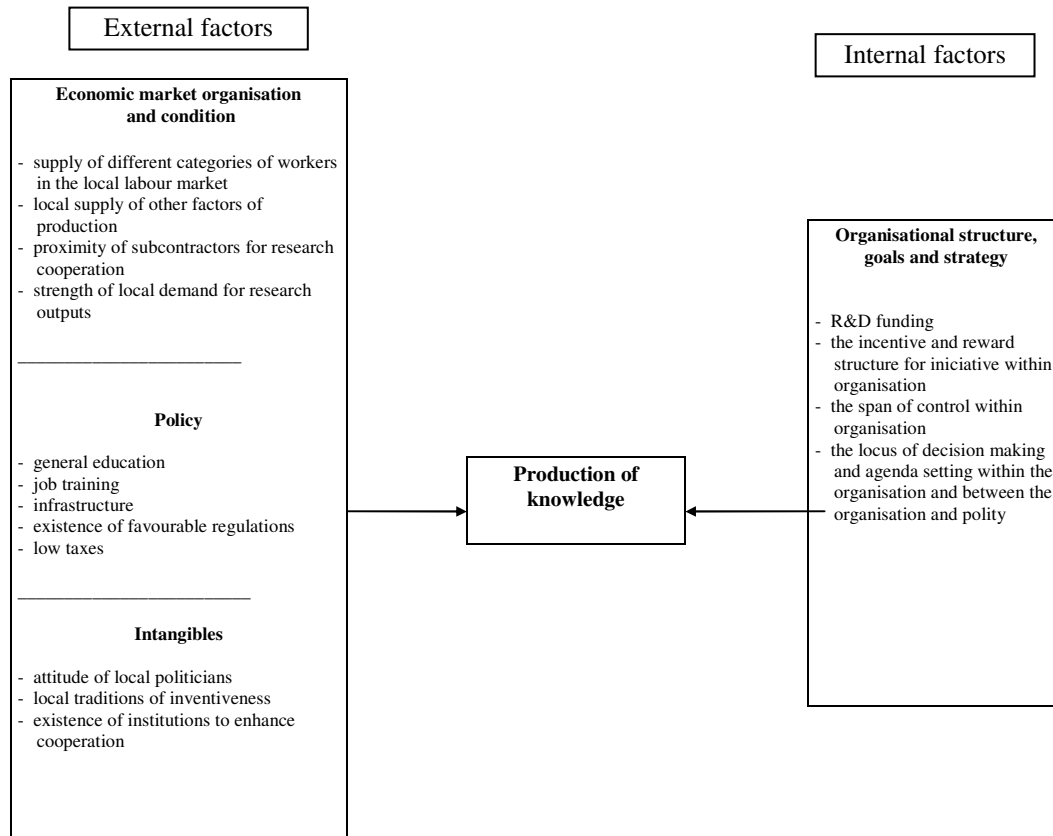


Figure 4 -Conceptual model of knowledge production
(M. Luger *et al*, 1991)

The external factors include not only a set of variables specific of the *milieux innovateurs* and there are expression of the influence of the conditions and organisation of the market but also the immaterial factors of a different nature.

The internal factors underline the importance of the organisational structure, the goals and the strategy of the university initiative in the field of the activities of R&D. The authors place in the centre of the analysis the behaviour of the university concerning the importance and financing of R&D, the incentives of the institution, the decision-taking process and the institutional strategic planning as well as the relationship between university and the political power.

Luger's *et al* contribution tries to relate phenomena of a static nature or of a dynamic one, considering the axiom of the influence of the contextual framework and giving structuring power in the medium run to the institutional behaviour. It becomes clear the comparison in the paradigm structure-conduct-performance used by the industrial economy in the analysis of the functioning of the markets.

4. Concluding remarks

There is a broad recognition about the role of the universities in knowledge-based society and the perception of the consequences in the relations with industry and government. However, the contextual conditions of less favoured regions map the circumstances and the specificity of the applicability of different approaches.

The structural economic and social conditions, the technological and innovation experience, the culture, the strategic capacity of the actors and institutional structure, the access to relevant information and others critical assets to the development and the vulnerability concerning exogenous impacts justify, among other factors, specific response in the fields of theoretical and methodological issues and policy actions.

As we have referred previously, it is easy to find in literature on innovation theories different perspectives which make the systems of innovation approach appear conceptually and methodologically diffuse. We have stressed that the situation reflected a complementary of point of the view as well as the stage of the trajectory of the knowledge in this field.

We have discussed a set of the methodologies and indicators with potential interest to regional planners and experts used to observing and evaluating the stage of the innovation system in their region. Nevertheless, we consider that this multiplicity of approaches focus only partially aspects of the innovative phenomena and each one demonstrate strengths and weaknesses.

For this reason, there is currently no single existing approach that could be consider as *best practice*.

The systemic nature of the innovative dynamics implies that the full efficiency of the university as a tool of the regional policy becomes influenced by the involvement in the

trajectory of the experience and learning of the other actors with particular relevance for the different levels of the government and the firms.

Actually, there is a lack of knowledge concerning the nature of the internal dynamics that promotes the structuration, in peripheral and disfavoured areas, of local systems of innovation based on the engine role of the university.

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